SRC2000

ULTRAMATCH

ULTRAMATCH
SAMPLE RATE &
FORMAT CONVERTER /
JITTER
MODEL SRC 2000

INPUT

OUT IN
SPDIF

OUT IN
AES / EBU

OUT IN
OPTICAL

SPDIF
AES / EBU
OPTICAL

ERROR

EMPHASIS

INTERNAL
EXTERNAL
LOCK

44.1 kHz
32 kHz

AUTO
NO EMP

PROFESSIONAL
CONSUMER

OUTPUT

INTERNAL
EXTERNAL
SYNC.

44.1 kHz
32 kHz
SAMPLE FREQ.

AUTO
NO EMPHASIS
EMPHASIS

PROFESSIONAL
CONSUMER
FORMAT

User´s Manual

Bedienungsanleitung

E
D

Version 1.2   January 1999

BEHRINGER®

CE

EG-Declaration of Conformity

BEHRINGER

Spezielle Studiotechnik GmbH

acc. to the Directives
89/336/EWG and 73/23/EWG

We,   BEHRINGER INTERNATIONAL GmbH

Hanns-Martin-Schleyer-Straße 4

D - 47877 Willich

herewith take the sole responsibility to confirm that the product:

ULTRAMATCH   SRC2000

which refers to this declaration, is in accordance with the following standards or standardized documents:

☒	EN 60065	☒	EN 61000-3-2
☒	EN 55020	☒	EN 61000-3-3
☒	EN 55013	☒	EN 55022

The following operation conditions and installation arrangements have to be presumed:

acc. to Operating Manual

BEHRINGER
INTERNATIONAL GmbH
Hanns-Martin-Schleyer-Str. 36-38
D-47877 Willich, Münchheide II
Tel.-Nr. 0 21 54 / 92 06-0
Fax-Nr. 0 21 54 / 92 06-30

B. Nier, President   Willich, 01.01.1999

SAFETY INSTRUCTIONS

CAUTION: To reduce the risk of electrical shock, do not remove
the cover (or back). No user serviceable parts inside;
refer servicing to qualified personnel.

WARNING: To reduce the risk of fire or electrical shock, do not
expose this appliance to rain or moisture.

DETA   **FETY INSTRUCTIO**
All the   ' operation in   , appliance is operated.
Retair   **:**
The sa   ure reference.
Heed V
All warn   ons should be adhered to.
Follow
All

                                              ar a bathtub, washbowl, kitchen sink, la   ib, in a wet

                                    tion or position does not interfere with its r   ton. For
                              n a bed, sofa rug, or similar surf   ck the
                              n, such as a bookcase or ca   le the

                              ch as radiat   er

                              type

                              polarization means of a

              uld be routed so that they are not likely to be walked on or
              paying particular attention to cords and plugs, convenience re
              the appliance.

            nould be cleaned only as recommended by the manufacturer.
          ds:
          ord of the appliance should be unplugged from the outlet when left unused for a long perio
            d Liquid Entry:
          ould be taken so that objects do not fall and liquids are not spilled into the enclosure through openi
          age Requiring Service:
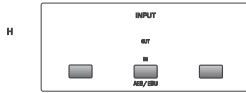   e appliance should be serviced by qualified service personnel when:
- The power supply cord or the plug has been damaged; or
- Objects have fallen, or liquid has been spilled into the appliance; or
- The appliance has been exposed to rain; or
- The appliance does not appear to operate normally or exhibits a marked change in performance; or
- The appliance has been dropped, or the enclosure damaged.
Servicing:
The user should not attempt to service the appliance beyond that is described in the Operating Instructions. All
other servicing should be referred to qualifield service personnel.

ULTRAMATCH

Provides virtually all possible digital format conversions of professional and consumer modes, AES/EBU, SPDIF coaxial or optical

H

INPUT

OUT

IN

AES/EBU

AUTO

IN

EMPHASIS

PROFESSIONAL

CONSUMER

FORMAT

▲ Accepts sampli

▲ Selectable inpu

▲ Converts into o

▲ The output sign

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* At this point we wo
and copyrights alway

SRC2000

FOREWORD

Dear Customer,

Welcome to the BEHRINGER ULTRAMATCH and thank you for placing your trust in BEHRINGER products. My most pleasant task is to write this letter to you, because it is the culmination of many months of hard work for our engineering team. Our daily objective is to be focused on you, the musician and sound engineer, and with that focus in mind, it drives us to reach a goal which is unique, and is the backbone of the BEHRINGER philosophy.

It is our philosophy to share our joy with you, because you are the most important member of the Behringer family. With your highly competent suggestions for new products you've greatly contributed to shaping our company and making it successful. In return, we guarantee you uncompromising quality (manufactured under the stringent quality system ISO9000) as well as excellent technical and audio properties at an extremely favorable price. All of this will enable you to fully unfold your creativity without being hampered by budget constraints.

We are often asked how we can make it to produce such high-grade devices at such unbelievably low prices. The answer is quite simple: it's you, our customers! Many satisfied customers means large sales volumes enabling us to get better conditions of purchase for components, etc. Isn't it only fair to pass this benefit back to you? Because we know that your success is our success, too!

I would like to thank all the people, whose help on the ULTRAMATCH has made it all possible. Everybody has made very personal contributions, starting from the designers of the unit via the many staff members in my company to you, the user of BEHRINGER products.

Thank you and sincerely yours,

Uli Behringer

TABLE OF CONTENT

1. INTRODUCTION

BEHRINGER ULTRAMATCH is an essential tool for modern recording studios. The importance of digital technology has grown immensely during the past years in home-recording as well as in semi-professional and professional studios. More and more operations are executed on the digital level. As a result, sound engineers and musicians are confronted with a multitude of new connectors, signal leads, and changed standards. Incompatibilities between two different devices are normal, and very often it turns out to be impossible to interconnect two devices from different manufacturers.

This situation made us develop the ULTRAMATCH - a multi-functional device that meets all the requirements modern studios expect. The ULTRAMATCH combines functions such as a digital patchbay, a signal refresher, an SCMS eraser, a jitter killer, a format converter, and an excellent sample rate converter within a single unit. Nevertheless, it is extremely user-friendly.

1.1 Some Words on Digital Sample Rate Conversion

Up to now, the conversion of various sample rates has necessitated an enormous amount of components, and yet has had manifold drawbacks, resulting in measurable signal falsifications such as increased noise, distortion, or unwanted „mirror" frequencies (high-frequency chirping). The new processor employed in the ULTRAMATCH executes a real-time conversion with total precision. It works absolutely stealthily, and its influence on the signal can be detected only by means of very expensive measuring instruments.

Let´s look at a model to explain this operation which describes the conception of interpolation and decimation of sample points. The processor performs an oversampling on the input signal, i. e. further samples are set between each two regular samples, resulting in a larger total number of samples by this "filling of the gaps". An equivalent oversampling with a factor of 65,536 corresponds to an internal sample rate of 3.2768 GHz. Afterwards, the signal is run through a variable low-pass filter, ensuring a correct aliasing limit. This process is started automatically whenever the sample rate at the output falls below the one at the input. Then, the number of sample points is reduced by division until the desired sample rate can be established at the output. Due to this enormous oversampling, the processor operates accurately over the entire audio-frequency band. Simultaneously, any jittering present in the input signal is removed.

No doubt, digital signal processing provides extremely low THD and noise values. However, signal recalculation especially in sample rate conversion used to lead to considerably non-linear results which is not surprising. The amount of data created in the interpolation model described above would totally overstrain conventional technology. 10 Mbytes of data per minute would have to be stored in standard stereo sampling. Multiplied by 65,536, there would be a data amount of 650 Gbytes! Even if this data were processed in small packages in order to avoid storage problems, sensible operation would be impracticable. Therefore, programmers have developed various algorithms that always used to be only a compromise between arithmetic expenditure and sound quality.

However, despite real-time data processing, the BEHRINGER ULTRAMATCH obtains fantastic results. The achieved noise level is below -120 dBFS and the distortion values are below -95 dBFS even at most complex input signals. That means that the processing executed by the ULTRAMATCH remains inaudible, since neither conventional A/D and D/A converters nor the final product - the CD - can achieve approximate values.

1.2 The AES/EBU and SPDIF Standards

During the past decade, two standards have been established for digital audio transmission (see **table 1.1**). The AES/EBU standard defines a professional balanced connection with XLR connectors, whereas the semi-professional SPDIF standard (developed by Sony and Philips) makes use of RCA or optical connections with light conductors. However, the SPDIF method standardized in IEC 958 has rather become known for its notorious copy protection.

Type	AES / EBU	IEC 958 (SPDIF)
Connection	XLR	RCA / Optical
Mode of operation	Balanced	Unbalanced
Impedance	110 Ohms	75 Ohms
Level	0.2 V to 5 V pp	0.2 V to 0.5 V pp
Clock Accuracy	not defined	I: ± 50 ppm II: 0,1 % III: Variable Pitch
Jitter	± 20 ns	not defined

Tab. 1.1: Important characteristics of the AES/EBU and IEC 958 standards.

Unfortunately, these standards soon became watered-down, since a lot of devices simply did not provide enough space for XLR jacks. In these units, either TRS jacks, mini jacks, or special adapters for Sub-D connectors were employed.

Besides the electrical differences, the physical realizations of the interface concepts are slightly different. The audio information is transmitted identically, meaning that in principle both formats are compatible. However, there are varying data blocks depending on which format is used. **Table 1.2** represents an extract from the data structure of the AES/EBU standard, **table 1.3** shows the corresponding data in SPDIF format. It is just the first bit that defines the following ones as a professional-type or consumer-type data stream.

It is obvious how the following bits differ in meaning. If a device such as a conventional DAT recorder features only an SPDIF input, it will accept only SPDIF data. When receiving professional-type data, the data reception is usually terminated since AES/EBU signals would lead to malfunctions in copy protection and emphasis if processed by a consumer-type device.

The problem is common to many plug-in connections. A lot of devices do not switch off transmission, others process both formats though equipped with just one interface type, and finally there are some that are simply faulty, refusing to operate correctly though the correct identification is received. The ULTRAMATCH is able to solve any of these problems. Whatever is received by the unit is transmitted from its output as a signal with correct identification in the selected format.

Byte	Bit							
	0	1	2	3	4	5	6	7
0	P/C	Audio?	Emphasis			Locked	Sampl. Freq.	
1	Channel Mode				Use of User bits			
2	Use of AUX bits			Length of audio sample			Reserved	
3	Reserved for description of multichannel recording							
4	Audio reference		Reserved					
5	Reserved							

Tab. 1.2: Identifying Information in Professional Format

Byte	Bit							
	0	1	2	3	4	5	6	7
0	P/C	Audio?	Copy	Emphasis			Mode	
1	Category code							Gen.St.
2	Source number				Channel number			
3	Sampling frequency				Clock accuracy		Reserved	

Tab. 1.3: Identifying Information in Consumer Format

2. THE CONCEPT

The BEHRINGER ULTRAMATCH is an especially flexible device meeting all the requirements of digital applications. Compared to most conventional sample rate converters, the ULTRAMATCH offers much more than mere sample rate conversion, due not only to various options for signal manipulation but also the provision of the complete input and output interface.

The front panel of the ULTRAMATCH is strictly functional and has a user-oriented design. The nature of the input signal and the selected mode of processing can be identified plainly. An separate error LED indicates the presence of a valid input signal, another LED points to a set emphasis bit. Since the ULTRAMATCH automatically synchronizes to any input signal with a sample rate between 25 kHz and 60 kHz, no selector is necessary for the input sample rate.

A convenient feature is the manipulation of a set emphasis bit which means that the audio signal is not changed, but only the identification contained in the digital data flow. You will usually activate the „auto" function that automatically passes the emphasis information through. In theory, this is standard because sound material recorded with (pre-) emphasis (fixed high-frequency boosting) has to be replayed with (de-) emphasis (fixed high-frequency cut) in order to avoid falsifying the signal.

In every-day studio life, however, it may be different. It is known that sometimes during mastering and cutting processes, the emphasis bit is set by defect hardware or software, though no high-frequency boosting is executed. Usually, this error remains unnoticed during the duplication process since most modern DAT recorders do not provide an emphasis indicator anymore. The subsequent delivering of the DAT tape becomes a rude awakening for the customer: The high-frequency cutting cannot be repaired anymore, and the sound quality is characterized by the absence of any brilliant high frequencies. That is why we provided the ULTRAMATCH with a special emphasis indicator as well as with a selector that allows to correct the emphasis bit manually.

2.1 The Quality of Components and Circuits

Due to our company's philosophy we only employ perfectly developed circuits and first-choice components. The heart of the ULTRAMATCH is a special SRC processor that dues to its specifications and excellent sound quality can be referred to as one of the best components ever used in digital processing. Additionally, low-tolerance resistors and capacitors, high-quality transmitters and switches, special digital circuits, and further carefully selected components are employed.

2.2 Digital Inputs and Outputs

2.2.1 XLR

The digital XLR inputs and outputs are not limited to the AES/EBU standard. They send and receive data in either professional and consumer format. It is even possible to connect the RCA output of a CD player, for example, to the XLR input of the ULTRAMATCH by means of an adapter(if for example the RCA input is connected to another device in a fixed installation).

2.2.2 RCA

The digital RCA inputs and outputs are not limited to the SPDIF standard. They send and receive data in either professional and consumer format. It is even possible to connect the XLR output of the BEHRINGER ULTRA-CURVE PRO DSP8024, for example, to the RCA input of the ULTRAMATCH by means of an adapter. The opposite (RCA output of the ULTRAMATCH to an XLR input of another device) depends on the sensitivity of the XLR input concerned but should also normally work without problems.

2.2.3 Optical (TOSLINK)

The optical inputs and outputs are not limited to the SPDIF standard. They send and receive data in either professional or consumer format.

☞ **Note: Many low-end devices require the consumer format sent by the ULTRAMATCH, otherwise they will not accept the signal.**

☞ **Note: The ADAT multi-track format is not supported by the ULTRAMATCH and is therefore neither passed through nor converted (ADAT is a registrated trademark of Alesis Corp.).**

2.2.4 Wordclock (BNC)

The BNC jack on the rear panel allows to connect the ULTRAMATCH to a wordclock source for synchronization purposes (s. a. 3.3.4). Wordclock signals are normally distributed in network technology, i. e. they are passed through with BNC-T adapters and terminated with appropriate resistor elements. In order to provide maximum flexibility, the BNC input of the ULTRAMATCH features a high-impedance resistor and is not equipped with the normal terminal resistor (75 Ohm).

3. INSTALLATION

Your BEHRINGER ULTRAMATCH was carefully packed in the factory and the packaging was designed to protect the unit from rough handling. Nevertheless, we recommend that you carefully examine the packaging and its contents for any signs of physical damage, which may have occurred in transit.

☞ **If the unit is damaged, please do not return it to us, but notify your dealer and the shipping company immediately, otherwise claims for damage or replacement may not be granted. Shipping claims must be made by the consignee.**

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3.1 Rack Mounting

The BEHRINGER ULTRAMATCH fits into one standard rack unit of space (1 3/4"). Please allow at least an additional 4" depth for the connectors on the back panel.

☞ **Be sure that there is enough air space around the unit for cooling and please do not place the ULTRAMATCH on high temperature devices such as power amplifiers etc. to avoid overheating.**

3.2 Mains Connection

The mains connection of the ULTRAMATCH is made by using a mains cable and a standard IEC receptacle. It meets all of the international safety certification requirements. Please make sure that all units have a proper ground connection. For your own safety, it is advisable not to remove the ground connection within the units or at the supply, or fail to make this connection at all.

☞ **Before you switch on the unit, check that it is configured to match your AC mains voltage**
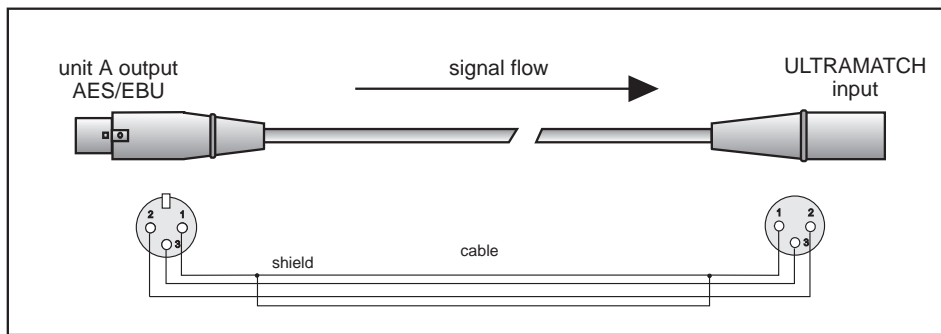
Fig.3.1: Balanced Connections (AES / EBU) to the ULTRAMATCH

3.3.2 Unbalanced Coaxial Connections (SPDIF)

The figure below shows how to connect the unbalanced inputs and outputs correctly by means of RCA cables. Basically, the connections are identical to unbalanced audio connections in stereo systems, for example when connecting a CD player to an amplifier.

Good results have been achieved independently of the selected cable. We recommend to use conventional line cables with a length of less than 10 m. However, for longer distances or exacting demands, use XLR or TOSLINK cables.
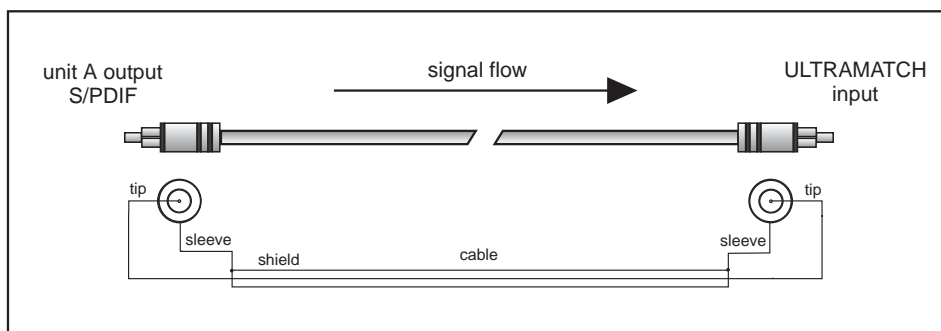

Fig.3.2: Unbalanced Connections (SPDIF) to the ULTRAMATCH

3.3.3 Optical Connections (SPDIF)

The figure below shows how to connect the optical inputs and outputs correctly. The optical system called TOSLINK makes use of other connectors than the ones employed in light wave conduction, though the systems are basically identical.

Optical connections are naturally unaffected by electric interference, easy to connect, and amazingly rugged. Unfortunately, they are said to cause extremely high jittering in the data stream, thus decreasing the sound quality of the decoded audio signal significantly although this „fairy tale" has not been proved yet. What is more, optical connections do not cause any jittering even at cable lengths of 10 m (whereas in practice there are often problems caused by transition resistors in RCA plugs or damaged cables). The real problems of distribution of standard (and customized) cables and their excessive prices.

3.3.5 Connections with Adapters

In some cases, it may be appropriate to connect the inputs and outputs of the ULTRAMATCH to other devices by means of adapter units. For example, if you want to connect two DAT recorders to the ULTRAMATCH at the same time, and each of these recorders features only an SPDIF interface (RCA), you can easily connect one of these recorders to the ULTRAMATCH by means of an RCA-XLR adapter. The figure below shows e. g. the correct wiring of the adapter cables for input connection.
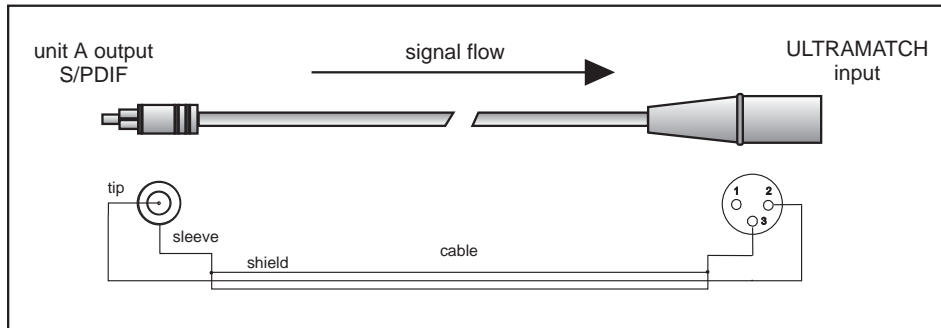
Fig. 3.6: Adapter Wiring for RCA Output to ULTRAMATCH's XLR Input

4. CONTROLS AND FUNCTIONS
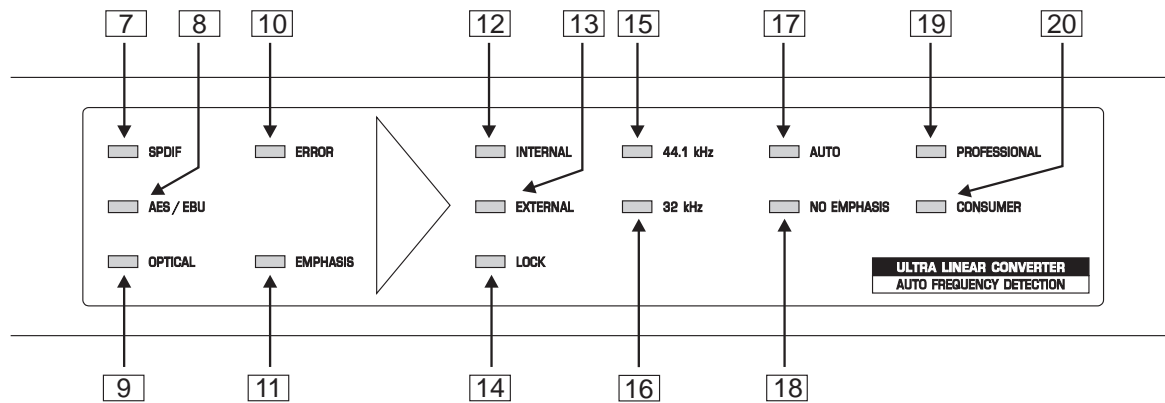
4.1 Front Panel

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4.1.2 LED-Display


Fig. 4.3: The Indicators of the LED Display Section

7   SPDIF Indicator. When the SPDIF input is activated, this LED is lit.

8   AES/EBU Indicator. When the AES/EBU input is activated, this LED is lit.

9   OPTICAL Indicator. When the optical input is activated, this LED is lit.

10   ERROR Indicator. When the input signal is faulty, this LED is lit. It indicates several malfunctions such as No Lock, Parity, CRC, Valid, etc. When the LED is lit, the ULTRAMATCH is unable to process the input signal.

11   EMPHASIS Indicator. When the emphasis bit in the input signal is set, this LED is lit.

12   INTERNAL Indicator. When internal synchronization is activated, this LED is lit. The output sample rate of the audio signal can be selected with the SAMPLE FREQ switch.

13   EXTERNAL Indicator. When the SYNC switch is depressed, this LED is lit. The output sample rate of the audio signal coincides with the rate present at the wordclock input.

14   LOCK Indicator. This LED is lit when a valid signal is present at the wordclock input and the ULTRAMATCH has locked to this signal.

15   44.1 kHz Indicator. When the SAMPLE FREQ switch is not depressed, this LED is lit. In this case, the sample rate of the output signal is 44.1 kHz.

16   32 kHz Indicator. When the SAMPLE FREQ switch is depressed, this LED is lit. In this case, the sample rate of the output signal is 32 kHz.

17   AUTO Indicator. When the EMPHASIS switch is not depressed, this LED is lit. The emphasis information received is passed through to the output without change.

18   NO EMPHASIS Indicator. When the EMPHASIS switch is depressed, this LED is lit. The emphasis information received is *not* passed through to the output, meaning that it is deactivated..

19   PROFESSIONAL Indicator. When the FORMAT switch is not depressed, this LED is lit. This corresponds to the channel status set on the output signal.

20   CONSUMER Indicator. When the FORMAT switch is depressed, this LED is lit. This corresponds to the channel status set on the output signal.

...clock
...signal!
...wordclock
...MPLE FREQ

...ceived at the input is
...the output (NO EMPHA-

...the ULTRAMATCH defined in the

OPTICAL   SPDIF   OPTICAL

INPUTS
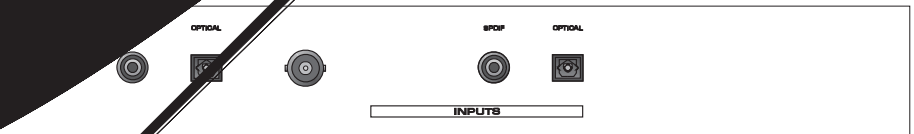
5. MODE OF OPERATION

The ULTRAMATCH is an all-purpose device for modern recording studios. It provides not only sample rate conversion but also format and standard conversion, and additionally allows you to manipulate part of the information transmitted with the audio signal. The ULTRAMATCH features no bypass mode, since input and output signal are practically identical if the same sample rate is applied to both input and output.

☞ **Note: Special data formats for backup purposes, that do not contain audio data (streamer applications etc.) cannot be processed with the ULTRAMATCH.**

5.1 Basic Settings

When powered up, the ULTRAMATCH automatically generates a basic setting suitable for most applications, thus relieving the user from unnecessary work. The input to be activated is automatically selected by a simple priority logic, and the active mode of operation is indicated by the corresponding LED.

5.2 Elimination of Errors

The ERROR LED indicates if a valid signal is recognized at the input of the ULTRAMATCH. If a device connected to the output of the ULTRAMATCH does not work properly, the wrong format has probably been selected. Change the format of the output signal by pressing the FORMAT switch.

5.3 Conversion to 32 kHz

Though 44.1 kHz is a generally accepted standard for digital audio signals, there are good reasons for converting the signal to 32 kHz: This sample rate is not only compelling for some applications (digital broadcasting systems, long-play mode) but also necessary if memory is critical (one minute of sample data requires only 7 Mbytes instead of 10 Mbytes).

5.4 Emphasis Correction

If the EMPHASIS switch is set to AUTO, the emphasis information is transmitted to the output as received at the input. If the emphasis bit is wrongly set due to incorrect pre-processing or defective software or hardware, press the EMPHASIS switch to suppress the output of the emphasis information. The EMPHASIS LED indicates if an emphasis-coded signal is received at the input.

6. APPLICATIONS

The universal full-function concept of the ULTRAMATCH allows plenty of applications. It turns out to be an ultimate tool, providing useful solutions for almost any problem. The power of the ULTRAMATCH is accessible via a simple and intelligible user-interface, allowing quick and easy operation.

6.1 Sample Rate Conversion

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No matter what kind of material is received, the ULTRAMATCH converts it to a standard format. In every-day studio life, lots of possible applications are imaginable:

▲ conversion from 48 kHz (DAT recordings) to 44.1 kHz (CD standard rate);

▲ conversion from 44.056 kHz (old-standard digital recordings) to 44.1 kHz (CD standard rate);

▲ conversion from 32 kHz (non-CD standard material) to 44.1 kHz (CD standard rate).

6.1.1 Operation in a DAT-Based Studio

Only recently, inexpensive DAT recorders have been introduced that are able to record analog signals directly with a sample rate of 44.1 kHz. Most DAT recorders, however, only allow recordings with a sample rate of 48 kHz. Usually, such recordings have to be re-recorded then from the consumer DAT recorder to a professional recorder via analog connections. The necessary D/A and A/D conversions lead to an unwanted deterioration in quality of the original material. The use of the ULTRAMATCH eliminates this problem by converting the sample rate on the purely digital level, resulting in a significantly higher quality of the audio material.

Other inconveniences, such as incompatible identifications, wrong formats, or an unstable sample rate, are corrected by the ULTRAMATCH in real-time. Thus, the ULTRAMATCH allows real high-quality re-recordings.

6.1.2 Harddisk Recording

Harddisk recording applications require a uniform sample rate, preferably the one used by the medium to be employed (i.e. the CD). In this case, too, the ULTRAMATCH allows re-recordings on the digital level by a conversion from sources with a rate of 32 kHz or 48 kHz to the standardized 44.1 kHz.

Of course, the ULTRAMATCH can be inserted anywhere in the signal path, even between a computer and the DAT recorder. In non-critical applications, the material can be edited with the computer with a rate of 32 kHz and then be converted to 44.1 kHz while recording it to DAT.

6.1.3 Reduction of Memory Requirements

One minute material sampled with a rate of 44.1 kHz requires about 10 Mbytes memory. If the sample rate was reduced down to 32 kHz, only 7 Mbytes of data would have to be stored. When large amounts of audio material have to be recorded or backed up, a lot of memory and costs can be saved.

The steep-curved digital filter integrated in the SRC processor of the ULTRAMATCH and the high-quality processing of the input material often allows a conversion to 32 kHz without any audible deterioration in quality. Non-critical material (especially radio or video spots, sound archives, etc.) remains almost unchanged in sound when the transmission rate is limited to 15 kHz, thus remaining entirely fit for later use with regard to the purpose it was recorded for. The integrated digital filter operates with significantly better results than compara-ble filters in A/D converters, leading to a purer and more transparent sound than direct recordings with a sample rate of 32 kHz. We recommend: Just try it!

6.1.4 Master/Slave Conflicts

Master/slave conflicts occur at the latest when a digital mixing console is employed. There is a simple expla-nation: In "normal" configurations with CD players, DAT recorders, and hard disk recorders, the replaying device is the master, the recording one acts as slave. When the CD player transmits a signal with a rate of 44.1 kHz, the recording DAT device automatically synchronizes.

If a mixing console is inserted between CD player and DAT recorder, the CD player will the master device and the console the slave device. However, the connected DAT player is used for recording as well as for playing -

the model collapses! The mixing console can only lock to one master source, the audio data received from the other device would be processed wrongly since no synchronization data are available. The only thing one would hear is interference.

The synchronization requirements in a digital studio can be met by connecting a central sync master. For instance, the mixing console may act as master and controls all other devices by transmitting a reference code (word clock). However, this is only possible if any slave device in the network features a sync input. In a recording studio with digital recording devices, digital effect units, and hard disk recording systems, conventional CD players and DAT recorders cannot be connected to the mixer since they do not provide synchronization facilities.

The ULTRAMATCH solves this problem by defining any connected device as slave if the external sync input is used. It acts as interconnection, and the transmission ratio of 65536:1 always provides a gap in the gear. The signal received from the device to be synchronized is re-synchronized to the wordclock source during the sample rate conversion (see also 1.1).

Thus, any device in a studio with central sync source can be connected to any other device via the ULTRAMATCH independently of the original abilities.

☞ **In this mode of operation, the setting of the SAMPLE FREQ switch has no effect on the sample rate, but an identifying information (32 kHz or 44.1 kHz) is generated as part of the output signal! This is important since DAT recorders cannot be switched over to record mode if a wrong sample rate is recognized.**

6.1.5 Correction of unformatted passages

Especially with DAT recorders it can happen that due to bit by bit recordings there remain gaps of the formatted stream between the several recordings. In addition to that often short rests of samplerate information remain on the tape when old recordings are taped with new material. In these cases the ULTRAMATCH converts the peaces of information in a reliable stream of data with a fixed sample frequency. Even if the DAT recorder or any other digital source is stopped or switched off, the ULTRAMATCH continues producing a constant signal (of course without audio information).

6.2 SCMS Removal

The copy protection originally included in DAT recorders was simple yet effective: recordings from CD were not possible on the digital level. Later, the SCMS standard was introduced, allowing at least one single digital copy. The action of SCMS depends on the generation (i. e. how many copies have been drawn previously) and the origin (category) of the digital audio material. In professional recording, copy protection makes no sense (actually, no copy protection has been defined as part of the AES/EBU standard).

Since a lot of recording studios employ inexpensive consumer devices, problems related to copy protection and differences in format (consumer vs. professional) are a daily occurrence. The ULTRAMATCH ignores any SCMS information and generates a new, entirely SCMS-free information, thus allowing multiple copies on the digital level. Therefore, the ULTRAMATCH may also serve as an aid between two consumer DAT recorders.

☞ **At this point we would like to point out again that, in spite of the possibility to remove the copy prohibit bit, author- and copyrights always have to remain preserved. This device was not developed to create illegal copies!**

6.3 Line Booster, Signal Refresher

Long cables or the use of a patchbay often lead to a deterioration in signal quality, resulting in increased noise or even a connection breakdown. Due to a special input circuitry, the ULTRAMATCH removes jittering, interference, and level drops, and transmits a perfect output signal. Hence, the ULTRAMATCH can also be used to refresh signals affected by long cables or to reconstruct weak and falsified signals.

6.4 Sample Rate Correction

The sample rate of a device is often subject to slight deviations due to environmental temperature and aging. Normally, an automatic interception circuit (PLL) corrects unsteady and slightly deviating rates, thus providing trouble-free operation. However, if such deviations exceed a certain limit, the receiving unit cannot synchronize

to the transmitted rate and automatically cancels operation.

With the ULTRAMATCH, such restrictions are history. Correct operation is provided not only for a limited range around the selected sample rate but for any sample rate between 25 kHz and 60 kHz. Moreover, the signal transmitted by the ULTRAMATCH is always synchronized to a correct rate of 44.1 kHz or 32 kHz. Therefore, deliberately changed sample rates (for instance, by a varipitch function provided in samplers and certain CD players) as well as too unsteady rates can be corrected by the ULTRAMATCH and processed further.

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6.5 Varispeed Applications

There may be several reasons to apply a change in speed to a digital recording, for example pitch change or synchronization to other devices. In such cases, the ULTRAMATCH locks to changes in sample rates and transmits the output signal with a fixed rate of 44.1 kHz or 32 kHz. Thus, it reliably solves any problems related to unsteady sample rates in a multi-unit network which else would make digital processing of the material impossible.

6.6 Format Conversion

Quite often, format-related problems occur when a digital copy is drawn. While some devices explicitly require SPDIF information at the input, others can only transmit signals in AES/EBU format. The ULTRAMATCH solves this problem, too. It accepts signals in any known format. The output signal can be set either to AES/EBU or SPDIF format. Thus, it makes digital copying a mere question of the correct switch to be pressed.

6.7 Format Interface

A lot of CD players do not feature coaxial outputs but only optical ones. On the other hand, some DAT recorders only provide coaxial inputs. Digital interfaces for home-recording purposes are only equipped with either optical or coaxial connectors. If then a digital copy is to be drawn, the user finds out that one device features an optical connector and the other one a coaxial RCA jack. A connection to professional devices is difficult to establish because of the XLR jacks provided there, and consumer devices only equipped with optical connectors cannot be connected to professional devices at all.

Such incompatibilities and problems with different inputs and outputs are solved when using the ULTRAMATCH. For instance, if the CD player features only an optical digital output and the DAT recorder a coaxial RCA input, the ULTRAMATCH provides any necessary input and output to establish the correct connection. Generally speaking, *any* device available can be combined with any other!

6.8 Patchbay/Split Operation

The inputs and outputs of the ULTRAMATCH can all be used simultaneously. In this case, the input selector acts as a mini patchbay since it defines the signal to be output. There is no need to make a similar setting for the output as the receiving unit decides if a signal is accepted or not (for example, by activated/deactivated recording mode). Therefore, all outputs of the ULTRAMATCH are active at the same time, transmitting identical signals.

This threefold signal output allows split operation. This can be useful if, for instance, a multiple copy is drawn on several DAT recorders, or if a hearing check-up of the output signal is made by means of an additional D/A converter. This feature is especially useful for devices that do not pass the input signal through to the output.

6.9 The ULTRAMATCH in a home-recording studio

The ULTRAMATCH can be used as an integrated part of a home-recording studio, too, since many problems the professional sound engineer has to face also apply to the dedicated music listener and composer: connection problems between optical and coaxial interfaces, SCMS removal, sample rate conversion from 48 kHz to 44.1 kHz, or a digital patchbay for various audio sources.

The sophisticated conception of the ULTRAMATCH proves so flexible in practical operation that even problems

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can be solved that were not known to the engineers during the development process. Digital media such as Mini Disc (MD) or DCC (Digital Compact Cassette) have spread widely during the past years. However, such devices are not able to record via their digital input with a sample rate of 32 kHz. Due to that, it is not possible to record digital radio broadcasts directly; a D/A conversion with subsequent A/D conversion seems to be unavoidable. The ULTRAMATCH, however, converts the sample rate from 32 kHz to 44.1 kHz and even removes any copy protection.

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7. SPECIFICATIONS

Digital Input 1
Type	XLR, transformer-balanced
Standard	AES/EBU
Impedance	110 Ohm
Nominal Input Level	0.2 V ~ 10 V peak-to-peak

Digital Input 2
Type	RCA, transformer-balanced
Standard	SPDIF
Impedance	75 Ohm
Nominal Input Level	0.15 V ~ 10 V peak-to-peak

Digital Input 3
Type	TOSLINK, optical light conductor
Standard	SPDIF

Sync Input
Type	BNC
Standard	Wordclock (1 x SF)
Impedance	50 kOhm
Nominal Input Level	2 V ~ 10 V peak-to-peak

Digital Output 1
Type	XLR, transformer-balanced
Standard	AES/EBU
Impedance	110 Ohm balanced
Nominal Output Level	5 V peak-to-peak

Digital Output 2
Type	RCA, transformer-balanced
Standard	SPDIF
Impedance	75 Ohm
Nominal Output Level	0.5 V peak-to-peak

Digital Output 3
Type	TOSLINK, optical light conductor
Standard	SPDIF

Jittering Suppression
Jittering tolerance at the inputs	> 40 ns
Self-produced output jittering	< 2 ns
Self-produced jittering (external sync)	< 20 ns, (typically 10 ns)

Channel status information on the output signal
Professional Mode	Professional, Audio Use, Stereo, No Emphasis or 50/15 µs, Fs=32 kHz or 44.1 kHz
Consumer Mode	Consumer, Audio Use, 2-Channel, Digital Audio Tape, Original Material, Copy Permit, No Emphasis or 50/15 µs, Fs=32 kHz or 44.1 kHz

Power Consumption
Mains Voltages	USA/Canada	~ 120 V AC, 60 Hz
	U.K./Australia	~ 240 V AC, 50 Hz
	Europe	~ 230 V AC, 50 Hz
	General Export Model	~ 100-120 V AC, ~ 200-240 V AC, 50-60 Hz
Fuse	100-120 V AC: **100 mA (slow-blow)**	
	200-240 V AC: **50 mA (slow-blow)**	
Power Consumption	10 Watts	
Mains Connection	Standard IEC receptacle	

Dimensions & Weight

Dimensions	1 3/4" (44.5 mm) x 19" (482.6 mm) x 7 1/2" (190.5 mm)
Weight	2 kg
including package	3.2 kg

BEHRINGER is constantly striving to maintain the highest professional standards. As a result of these efforts, modifications may be made from time to time to existing products without prior notice. Specifications and appearance may differ from those listed or shown.

7. SPECIFICATIONS

8. WARRANTY

§ 1 WARRANTY CARD

To be protected by this warranty, the buyer must complete and return the enclosed warranty card (signed/stamped by retail dealer) within 14 days of the date of purchase to BEHRINGER INTERNATIONAL (address see § 3). Failure to return the card in due time (date as per postmark) will void any extended warranty claims.

§ 2 WARRANTY

1. BEHRINGER INTERNATIONAL warrants the mechanical and electronic components of this product to be free of defects in material and workmanship for a period of one (1) year from the original date of purchase, in accordance with the warranty regulations described below. If any defects occur within the specified warranty period that are not caused by normal wear or inappropriate use, BEHRINGER INTERNATIONAL shall, at its sole discretion, either repair or replace the product.

2. If the warranty claim proves to be justified, the product will be returned freight prepaid by BEHRINGER INTERNATIONAL within Germany. Outside of Germany, the product will be returned at the buyer's expense.

3. Warranty claims other than those indicated above are expressly excluded.

§ 3 RETURN AUTHORIZATION NUMBER

1. To obtain warranty service, the buyer must call BEHRINGER INTERNATIONAL during normal business hours BEFORE returning the product (Tel.: +49 (0) 21 54 / 92 06 66). All inquiries must be accompanied by a description of the problem. BEHRINGER INTERNATIONAL will then issue a return authorization number.

2. The product must be returned in its original shipping carton, together with the return authorization number, to the following address:

BEHRINGER INTERNATIONAL GmbH
Service Department

Hanns-Martin-Schleyer-Str. 36-38

D - 47877 Willich-Münchheide

3. Shipments without freight prepaid will not be accepted.

§ 4 WARRANTY REGULATIONS

1. Warranty services will be furnished only if the product is accompanied by an original retail dealer's invoice. Any product deemed eligible for repair or replacement by BEHRINGER INTERNATIONAL under the terms of this warranty will be repaired or replaced within 30 days of receipt of the product at BEHRINGER INTERNATIONAL.

2. If the product needs to be modified or adapted in order to comply with applicable technical or safety standards on a national or local level, in any country which is not the country for which the product was originally developed and manufactured, this modification/adaptation shall not be considered a defect in materials or workmanship. The warranty does not cover any such modification/adaptation, irrespective of whether it was carried out properly or not. Under the terms of this warranty, BEHRINGER INTERNATIONAL shall not be held responsible for any cost resulting from such a modification/adaptation.

3. Free inspections, maintenance/repair work and replacement of parts are expressly excluded from this warranty, in particular if caused by inappropriate use. Likewise, the warranty does not cover defects of expendable parts caused by normal wear of the product. Expendable parts are typically faders, potentiometers, switches and similar components.

4. Damages/defects caused by the following conditions are not covered by this warranty:

▲ misuse, neglect or failure to operate the unit in compliance with the instructions given in the user or service manuals.

▲ connection or operation of the unit in any way that does not comply with the technical or safety regulations applicable in the country where the product is used.

▲ damages/defects that are caused by force majeure or by any other condition beyond the control of BEHRINGER INTERNATIONAL.

5. Any repair carried out by unauthorized personnel will void the warranty.

6. Products which do not meet the terms of this warranty will be repaired exclusively at the buyer's expense. BEHRINGER INTERNATIONAL will inform the buyer of any such circumstance. If the buyer fails to submit a written repair order within 4 weeks after notification, BEHRINGER INTERNATIONAL will return the unit C.O.D. with a separate invoice for freight and packing. Such cost will also be invoiced separately when the buyer has sent in a written repair order.

§ 5 WARRANTY TRANSFERABILITY

This warranty is extended exclusively to the original buyer (customer of retail dealer) and is not transferable to anyone who may subsequently purchase this product. No other person (retail dealer, etc.) shall be entitled to give any warranty promise on behalf of BEHRINGER INTERNATIONAL.

§ 6 CLAIM FOR DAMAGES

Failure of BEHRINGER INTERNATIONAL to provide proper warranty service shall not entitle the buyer to claim (consequential) damages. In no event shall the liability of BEHRINGER INTERNATIONAL exceed the invoiced value of the product.

§ 7 OTHER WARRANTY RIGHTS

This warranty does not exclude or limit the buyer's statutory rights provided by national law, in particular, any such rights against the seller that arise from a legally effective purchase contract.